How Challenging is the Path from Nanoscience to Nanotechnology?
A Computational Condensed-Matter Physicist Perspective

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Efforts to assemble functional materials with atomic precision has energized scientists and engineers to eventually lead to the field of nanoscience. The development of nanoscience is a premise for new technological advances with unprecedented functionalities and miniaturization, and scientific scrutiny must now shift to translating nanoscience discoveries into technological realizations. However, the road from nanoscience to nanotechnology is a difficult one, as fundamental issues related to quality of interfaces, materials homogeneity and integration into existing technology must all be satisfactorily addressed. In this talk, I will present examples from our quest to optimize properties at the atomic and nano-scales for macroscopic applications in areas such as energy harvesting, storage, water purification, electronic device design, and biophysics. The use of large-scale supercomputing will be highlighted to demonstrate how current capabilities are quickly closing the gap between realistic length and time scales with those amenable to state-of-the-art modeling.

Dr. Vincent Meunier is a Professor in the Department of Physics, Applied Physics and Astronomy and in the Materials Science and Engineering departments at Rensselaer Polytechnic Institute, where he holds the Gail and Jeffrey L. Kodosky ’70 Constellation Chair. Meunier earned his PhD from the University of Namur in Belgium in 1999 and was a senior research and development staff member at Oak Ridge National Laboratory until 2010, when he joined Rensselaer. He has published more than 175 papers in peer-reviewed journals and is a fellow of the American Physical Society. Meunier leads the Innovative Computational Material Physics (ICMP) group, where his research uses computation to examine the atom-level details of materials. He is particularly interested in low-dimensional materials and domains where he can collaboratively work with engineers and experimentalists to optimize these materials, starting at the atomic level and targeting higher-level functionality.